1986

ANNUAL QUALITY ASSURANCE PERFORMANCE REPORT

SECTION 1

APIOS SAMPLES

INORGANIC TRACE CONTAMINANTS SECTION

G. C. RONAN, DIRECTOR
Laboratory Services Branch
Ministry of the Environment

1986

ANNUAL QUALITY ASSURANCE PERFORMANCE REPORT

SECTION 1

APIOS SAMPLES

INORGANIC TRACE CONTAMINANTS SECTION

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Inorganic Trace Contaminants Section
Laboratory Services Branch
Ministry of the Environment

ALRJ

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INORGANIC TRACE CONTAMINANTS SECTION

SUMMARY

I. Introduction

The Inorganic Trace Contaminants Section of the Ministry of the Environment, Laboratory Services Branch is responsible for the analysis of a wide variety of sample types for metals and non-metals. The use of sensitive instrumentation and methodologies appropriate to the sample matrix, combined with quality assurance programs, ensures that the Section is able to maintain a high standard of analytical performance. This performance is monitored through regular internal quality control and assurance programs as well as participation in interlaboratory round-robins. This QA report summarizes the methodologies used for analysis of these samples and the supporting internal quality assurance data.

This report is assembled in sections that reflect the analyses performed on different sample matrices in support of the programs of the Ministry of the Environment. Coincidentally, these divisions also reflect the supervisory responsibilities within the Section.

II. Quality Control and Assurance

The objectives of the quality control and assurance programs are to ensure that all of the components of the analytical process are under control and to ensure immediate detection and correction of unacceptable analytical performance. The program monitors all of the reagents, instrumentation, calibration and recovery components of the analytical system.

A. Quality Control

Quality control of the analytical process takes place at the instrument level and is intended to ensure that the instrumentation is operating according to established criteria. This control function ensures that instrument calibration, standardization, slope and intercept, and instrumental drift meet these criteria.

B. Quality Assurance

Quality assurance of the analytical process takes place after the results have been generated and is intended to ensure that the analytical protocols of sample preparation and digestion have been carried out correctly. This control function ensures that reagent blanks, digested standards, sample duplicates and recovery materials meet established response criteria.

III. Report Format

The report consists of one page method summaries and one page data summaries of blanks, between-run controls and within-run duplicates in formats that are common to all of the parameter/matrix combinations. The method summaries give a brief outline of the sample preparation and measurement procedures. The data summaries consist of annual mean values with standard deviations.

For the within-run duplicates, the data set is subdivided into ranges approximating 0 to 20 %, 20 to 50 % and 50 to 100% of the analytical range. All results for duplicates reported to the data base that are "<" or that have been diluted into the range are excluded from the statistical analysis.

The standard deviations for blanks and between-run controls are calculated using formula I. Formula II is used for the calculations for within-run duplicates.

$$sd = sqrt[\{(sumx2 - (sumx)2\}/n/(n-1)] \quad .....I$$

$$sd = sqrt(sumd2/2n) \quad .....II$$

where : x = the individual values; n = the number of events
d = the differences between pairs of duplicates

The data is stored in a personal computer using BMB Manager II files. All data manipulations, reports generated etc, are performed using applications written in Manager Math.

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1. APIOS Lovol Filters and Precipitation Samples

1.1 Lovol Filters

Lovol filters consist of 47 mm circles of Whatman 41 filters that are exposed to approximately 20 cubic meters of air per 24 hour sampling period. True sample duplicates cannot be taken since the whole filter is used during analysis. The samples are extracted initially with water for anion analysis and this extract may be split to generate duplicate data. Metals are determined on an acidified portion of the water leach and a separate second acid leach of the filter material.

1.2 Precipitation samples

Precipitation samples are collected in plastic bags and depending upon the collection devices used, may be either wet only, dry only, or wet and dry composites. Analysis is performed on an acidified portion of the liquid sample or on an acid leach of the container. Duplicates consist of taking separate portions of the original liquid or of the acid leach.

The following table summarizes the parameters determined in APIOS samples, the preparation procedure and method of analysis.

TABLE 1.1

Parameter	Collection Device	Preparation	Analysis
Metals	Whatman 41 filter	Acid digest	GFAAS
Metals	Plastic bags (liquid portion)	Acidified	GFAAS
Metals	Plastic bags (acid leach)	Acidified	GFAAS

1.3 APIOS Quality Assurance

QA samples consist of EPA solutions and blanks (filters). Duplicates are subsamples of the filter extracts or subaliquots of the contents of the collection bags in the case of the precipitation samples. The following table summarizes the QA sample used for the APIOS sample program.

TABLE 1.2

Sample Designation	Type	Parameter
epal,epah	EPA standard solutions	Metals
blk	Whatman 41 filter	Metals
Std4,5	Standard solutions	Metals

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Aluminum TEST CODE:ALUR SAMPLE TYPE:Lovolfilter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
20 µL of sample is injected into the furnace and 0 lpm is the internal argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .100 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.030 mg/L = .200 Abs Units
Instrument Detection Limit: .005 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 10 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.74	7.77
std. dev.	.108	.702
R.S.D.	14.6%	9.03%

Precision of Duplicates-

	low range	mid range	high range
s.d.	.050	.28	
mean	1.10	3.50	
W .5 µg/Fi		T 2.5 µg/Fi	

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

ALUMINUM-GF IN LOVOL FILTERS

Operating Range = .50000to 10.000 ug/filter

IN - RUN DUPLICATES

Range	<.50000	.50000to2.0000	2.0000to5.0000	5.0000to10.000	>10.000
no.	6	4	1	0	4
s.w.		0.05000	0.28000	0.00000	
mean		1.1000	3.5000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	54	0.74000	0.10800	14.59
epah	63	7.7700	0.70200	9.03

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	46	.84000	.65400

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Cadmium TEST CODE:CDUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
90 µL of sample is injected into the furnace and 50 lpm is the inter. argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .01 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.005 mg/L = .450 Abs Units- Peak Height Mode
Instrument Detection Limit: .00002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 1 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.040	.355
std. dev.	.0050	.0325
R.S.D.	12.5%	9.15%

Precision of Duplicates-low range mid range high range

s.d.	.0040	.0204
mean	.039	.219

W .002µg/Fi T .010µg/Fi

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

CADMIUM-GF IN LOVOL FILTERS

Operating Range = .00200to 1.000 ug/filter

IN - RUN DUPLICATES

Range	<.00200	.00200to0.2000	0.2000to0.5000	0.5000to 1.000	> 1.000
no.	5	11	2	0	0
s.w.		0.00400	0.02040	0.00000	
mean		0.0390	0.2190	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	64	0.04000	0.00500	12.50
epah	32	0.3500	0.03400	9.71

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	61	.03000	.04100

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Calcium TEST CODE:CAUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with .3ml of conc. HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .8N HNO3 in a closed tube overnight at 90C. Both solutions are analyzed by ICP/ES. The results from the two solutions are combined in reporting in the units of ug/filter.

INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Jarrel Ash Atom-Comp-ICP Model 975

Calibration Range:0 to 50 mg/L
Resolution:0.02 mg/L
Sensitivity:
Instrument Detection Limit: .02 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 500 µg/filter(µg/Fi)
Accuracy-
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 1.03
mean 46.5
W 2 µg/Fi T 10 µg/Fi

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

CALCIUM IN LOVOL FILTERS

Operating Range = 2.0 to 500.0

IN - RUN DUPLICATES

Range	<2.0	2.0 to 100.0	100.0 to 250.0	250.0 to 500.0	>500.0
no.	2	6	0	0	0
s.w.		1.03	0.00	0.00	
mean		46.46	0.00	0.00	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
rb	18	0.00	0.00

DATE 87/11/03

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Copper TEST CODE:CUUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
90 µL of sample is injected into the furnace and 50 lpm is the inter. argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .060 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.030 mg/L = .250 Abs Units- Peak Height Mode
Instrument Detection Limit: .0002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 6 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.360	3.43
std. dev.	.035	.186
R.S.D.	9.72%	5.42%

Precision of Duplicates-low range mid range high range
s.d. .022
mean .35
W .02 µg/Fi T .10 µg/Fi

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

COPPER-GF IN LOVOL FILTERS

Operating Range = .02000 to 6.000 ug/filter

IN - RUN DUPLICATES

Range	<.02000	.02000 to 1.2000	1.2000 to 3.0000	3.0000 to 6.000	> 6.000
no.	1	11	0	0	0
s.w.		0.02200	0.00000	0.00000	
mean		0.3500	0.0000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	75	0.36000	0.03500	9.72
epah	31	3.4300	0.18600	5.42

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	91	.12000	.16300

DATE 87/10/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Iron TEST CODE:FEUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
20 µL of sample is injected into the furnace and 50 lpm is the inter. argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .10 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.03 mg/L = .200 Abs Units- Peak Height Mode
Instrument Detection Limit: .001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 10 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.780	7.95
std. dev.	.061	.507
R.S.D.	7.82%	6.38%

Precision of Duplicates-low range mid range high range
s.d. .050
mean .80
W .1 µg/Fi T .5 µg/Fi

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

IRON-GF IN LOVOL FILTERS

Operating Range = .10000to 10.000 ug/filter

IN - RUN DUPLICATES

Range	<.10000	.10000to2.0000	2.0000to5.0000	5.0000to10.000	>10.000
no.	3	9	0	0	2
s.w.		0.05000	0.00000	0.00000	
mean		0.8000	0.0000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	49	0.78000	0.06400	8.21
epah	43	7.9500	0.50900	6.40

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	49	.27000	.21100

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Lead TEST CODE:PBUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
20 µL of sample is injected into the furnace and 50 lpm is the inter. argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .10 mg/L
Resolution:0.001 Abs. Units
Sensitivity: 0.03 mg/L = .200 Abs Units- Peak Height Mode
Instrument Detection Limit: .001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 10 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.435	4.345
std. dev.	.046	.571
R.S.D.	10.7%	13.1%

Precision of Duplicates-

	low range	mid range	high range
s.d.	.045	.220	
mean	.550	4.60	4.60
W .1 µg/Fi		T .5 µg/Fi	

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

LEAD-GF IN LOVOL FILTERS

Operating Range = .10000to 10.000 ug/filter

IN - RUN DUPLICATES

Range	<.10000	.10000to2.0000	2.0000to5.0000	5.0000to10.000	>10.000
no.	5	9	2	0	1
s.w.		0.04000	0.22000	0.00000	
mean		0.5500	4.6000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	73	0.44000	0.04600	10.45
epah	63	4.3600	0.60800	13.94

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	71	.26000	.25500

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Magnesium TEST CODE:MGUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with .3ml of conc. HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .8N HNO3 in a closed tube overnight at 90C. Both solutions are analyzed by ICP/ES. The results from the two solutions are combined in reporting in the units of ug/filter.

INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Jarrel Ash Atom-Comp-ICP Model 975

Calibration Range:0 to 50 mg/L
Resolution:0.02 mg/L
Sensitivity:
Instrument Detection Limit: .02 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 500 µg/filter(µg/Fi)
Accuracy-
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. .19
mean 9.1
W 2 µg/Fi T 10 µg/Fi

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

MAGNESIUM IN LOVOL FILTERS

Operating Range = 2.0 to 500.0 ug/filter

IN - RUN DUPLICATES

Range	<2.0	2.0 to100.0	100.0 to250.0	250.0 to500.0	>500.0
no.	2	5	0	0	0
s.w.		0.19	0.00	0.00	
mean		9.05	0.00	0.00	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
rb	18	0.00	0.00

DATE 87/11/03

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Manganese TEST CODE:MNUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
20 µL of sample is injected into the furnace and 50 lpm is the inter. argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .06 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.010 mg/L = .210 Abs Units- Peak Height Mode
Instrument Detection Limit: .001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 6 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.340	3.57
std. dev.	.0415	.471
R.S.D.	12.2%	13.2%

Precision of Duplicates-low range mid range high range

s.d.	.010
mean	.40

W .1 µg/Fi T .5 µg/Fi

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

MANGANESE-GF IN LOVOL FILTERS

Operating Range = .10000to 6.000 ug/filter

IN - RUN DUPLICATES

Range	<.10000	.10000to1.2000	1.2000to3.0000	3.0000to 6.000	> 6.000
no.	4	11	2	1	0
s.w.		0.01000	0.00000	0.00000	
mean		0.4000	1.7000	4.5000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	67	0.34000	0.04200	12.35
epah	55	3.5800	0.47400	13.24

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	21	.44000	.36900

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Nickel TEST CODE:NIUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
90 µL of sample is injected into the furnace and 0 lpm is the internal argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .030 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.010 mg/L = .150 Abs Units- Peak Height Mode
Instrument Detection Limit: .0002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 3 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.220	2.10
std. dev.	.0150	.175
R.S.D.	6.82%	8.33%

Precision of Duplicates-low range mid range high range

s.d.	.011	.028
mean	.115	.980

W .02 µg/Fi T .10 µg/Fi

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

NICKEL-GF IN LOVOL FILTERS

Operating Range = .02000to 3.000 ug/filter

IN - RUN DUPLICATES

Range	<.02000	.02000to0.6000	0.6000to1.5000	1.5000to 3.000	> 3.000
no.	4	12	1	0	0
s.w.		0.01050	0.02800	0.00000	
mean		0.1150	0.9800	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	62	0.22000	0.01500	6.82
epah	43	2.1000	0.17500	8.33

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	83	.14000	.23300

DATE 87/10/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Vanadium TEST CODE:VVUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
90 µL of sample is injected into the furnace and 0 lpm is the internal argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .01 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.002 mg/L = .018 Abs Units- Peak Height Mode
Instrument Detection Limit: .0004 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 1 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.930	8.63
std. dev.	.079	.56
R.S.D.	8.44%	6.49%

Precision of Duplicates-low range mid range high range

s.d.	.010	.020
mean	.10	.30

W .05 µg/Fi T .25 µg/Fi

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

VANADIUM-GF IN LOVOL FILTERS

Operating Range = .04000to 1.000 ug/filter

IN - RUN DUPLICATES

Range	<.04000	.04000to0.2000	0.2000to0.5000	0.5000to 1.000	> 1.000
no.	12	5	1	0	0
s.w.		0.01000	0.02000	0.00000	
mean		0.1000	0.3000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	48	0.93000	0.07800	8.39
epah	4	8.6300	0.56000	6.49

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	16	.12000	.08900

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME:Zinc TEST CODE:ZNUR SAMPLE TYPE:Lovol filter
UNIT:Waters Unit SUPERVISOR:P. N. Vijan

METHOD CODE:527AF2
REVISION NO:1 DATE:Sept 1986
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required-one filter
Container-stored in a plastic petri dish
Preservative-
Other-

SAMPLE PREPARATION:Partial Extn.-yes Total Extn.- % Extracted-
Procedure-The exposed lovol filter is extracted with 50 ml of double distilled water in an ultrasonic bath for 20 min. Twenty ml. of the water extract is taken for anion &cation analysis. The filter and the water extract are separated by decanting solution into separate tube. The water solution is preserved with 1% ultrapure HNO3. The filter and insoluble contents are furthur extracted in 50 ml of .16N HNO3 in a closed tube overnight at 90°C. Both solutions are analyzed by GFAAS. The results from the two solutions are combined in reporting in the units of ug/filter.
20 µL of sample is injected into the furnace and 50 lpm is the inter. argon flow at atomization.
INTERFERENCES:Unknown

REPORTING RESULTS:ug per filter
INSTRUMENTATION:Perkin Elmer 603 or 2380 Atomic Absorption Spectrophotometer with a HGA400 or HGA500 furnace and AS40 autosampler

Calibration Range:0 to .100 mg/L
Resolution:0.001 Abs. Units
Sensitivity:.030 mg/L = .600 Abs Units- Peak Height Mode
Instrument Detection Limit: .001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range-0 to 10 µg/filter(µg/Fi)
Accuracy-
Precision of Controls-

	A	B
mean	.410	3.85
std. dev.	.049	.354
R.S.D.	12.0%	9.19%

Precision of Duplicates-

	low range	mid range	high range
s.d.	.040	.140	
mean	.80	3.60	
W .1 µg/Fi		T .5 µg/Fi	

CONTROL LIMITS:The epa controls should be within 15% of the given value

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

ZINC-GF IN LOVOL FILTERS

Operating Range = .10000to 10.000 ug/filter

IN - RUN DUPLICATES

Range	<.10000	.10000to2.0000	2.0000to5.0000	5.0000to10.000	>10.000
no.	9	6	1	0	1
s.w.		0.04000	0.14000	0.00000	
mean		0.8000	3.6000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	65	0.41000	0.04900	11.95
epah	30	3.8500	0.35400	9.19

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	44	.18000	.12100

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Aluminum TEST CODE: ALPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Al in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 500 µg/ml
Resolution: 0.01 µg/ml
Sensitivity:
Instrument Detection Limit: 0.08 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 20 µg/ml
Accuracy-93% at 0.68 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.0012 0.0062 0.0083
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

ALUMINIUM IN PRECIPITATION

Operating Range = .00200to 0.500 mg/L

IN - RUN DUPLICATES

Range	<.00200	.00200to0.1000	0.1000to0.2500	0.2500to 0.500	> 0.500
no.	0	45	2	0	0
s.w.		0.00540	0.07000	0.00000	
mean		0.0294	0.1678	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	11	0.00660	0.00638	96.67
qcstd	16	0.2505	0.03846	15.35

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	3	.19280	.10037

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Aluminum TEST CODE: ALPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 20 µL of sample, an argon internal flow of 0 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .100 mg/L
Resolution: 0.001 Abs. Units
Sensitivity:0.030 mg/L = .200 Abs. Units
Instrument Detection Limit: 0.005 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0069mg/L	.080
std. dev.	.0014mg/L	.0068
R.S.D.	20.4 %	8.5 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	.0013	.0020	.0022
mean	.014	.031	.077

W .001 mg/L T .010 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

ALUMINUM-GF IN PRECIPITATION

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	11	19	14	2	0
s.w.		0.00130	0.00200	0.00220	
mean		0.0140	0.0310	0.0770	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	22	0.00690	0.00141	20.43
epah	24	0.0804	0.00681	8.47
std 4	25	0.0098	0.00222	22.65
std 5	23	0.0215	0.00433	20.14

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	17	.00630	.00113

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Cadmium TEST CODE: CDPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Cd in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 4 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 100 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.005 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 0.5 µg/ml
Accuracy-99% at 0.38 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.00002 0.00020
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

CADMIUM IN PRECIPITATION

Operating Range = .00010to 0.010 mg/L

IN - RUN DUPLICATES

Range	<.00010	.00010to0.0020	0.0020to0.0050	0.0050to 0.010	> 0.010
no.	41	5	1	0	0
s.w.		0.00020	0.00030	0.00000	
mean		0.0003	0.0039	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	28	0.00280	0.00149	53.21
qcstd	17	0.1994	0.01839	9.22

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	2	.03410	.04080

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Cadmium TEST CODE: CDPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 90 µL of sample, an argon internal flow of 50 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 5 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .010 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.005 mg/L = .450 Abs. Units
Instrument Detection Limit: 0.00002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.010 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0004mg/L	.0036
std. dev.	.00004mgL	.0004
R.S.D.	10.0 %	11.7 %

Precision of Duplicates-low range mid range high range

s.d.	.00001		.0088
mean	.0002		.049

W .02 µg/L T .10 µg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

CADMIUM-GF IN PRECIPITATION

Operating Range = .00002to 0.010 mg/L

IN - RUN DUPLICATES

Range	<.00002	.00002to0.0020	0.0020to0.0050	0.0050to 0.010	> 0.010
no.	18	39	0	0	0
s.w.		0.00001	0.00000	0.00000	
mean		0.0002	0.0000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	28	0.00040	0.00004	10.00
epah	7	0.0036	0.00042	11.67
std 4	12	0.0102	0.00107	10.49
std 5	0	0.0000	0.00000	0.00

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	0	.00000	.00000

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Copper TEST CODE: CUPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Cu in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 100 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.006 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 1 µg/ml
Accuracy-91% at 0.31 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.0003 0.0005 0.0004
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

COPPER IN PRECIPITATION

Operating Range = .00030 to 0.050 mg/L

IN - RUN DUPLICATES

Range	<.00030	.00030 to 0.0100	0.0100 to 0.0250	0.0250 to 0.050	> 0.050
no.	8	37	0	2	0
s.w.		0.00120	0.00000	0.00350	
mean		0.0011	0.0000	0.0320	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	26	0.00310	0.00089	28.71
qcstd	17	0.2199	0.01771	8.05

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	20	.01350	.01492

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Copper TEST CODE: CUPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 90 µL of sample, an argon internal flow of 50 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 4 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range:0.0 to .060 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.030 mg/L gives .250 Abs. Units
Instrument Detection Limit: 0.0002
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.06 mg/L
Accuracy-91% at 0.31 µg/ml
Precision of Controls-

	A	B
mean	.0034mg/L	.0332
std. dev.	.0002mg/L	.0024
R.S.D.	5.9 %	7.1 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	0.0001		0.0006
mean	0.0015		0.0397

W .0002mg/L T .0020mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

COPPER-GF IN PRECIPITATION

Operating Range = .00020to 0.060 mg/L

IN - RUN DUPLICATES

Range	<.00020	.00020to0.0120	0.0120to0.0300	0.0300to 0.060	> 0.060
no.	23	22	0	1	0
s.w.		0.00011	0.00000	0.00057	
mean		0.0015	0.0000	0.0397	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	25	0.00340	0.00020	5.88
epah	11	0.0332	0.00236	7.11
std 4	22	0.0103	0.00151	14.66
std 5	15	0.0209	0.00218	10.43

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	10	.00020	.00004

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Iron TEST CODE: FEPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 198
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Fe in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 500 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.02 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 20 µg/ml
Accuracy-110% at 0.88 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.0018 0.0061 0.0129
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

IRON IN PRECIPITATION

Operating Range = .00100to 0.500 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.1000	0.1000to0.2500	0.2500to 0.500	> 0.500
no.	0	45	1	1	0
s.w.		0.00610	0.00500	0.15950	
mean		0.0216	0.1277	0.3799	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	24	0.01850	0.07496	405.19
qcstd	17	0.1940	0.04500	23.20

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	9	.09190	.07532

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Iron TEST CODE: FEPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 20 µL of sample, an argon internal flow of 50 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .100 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.030 mg/L gives .200 Abs. Units
Instrument Detection Limit: 0.001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0076mg/L	.079
std. dev.	.0007mg/L	.0043
R.S.D.	8.6 %	5.5 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	.0014	.0026	
mean	.011	.025	

W .001 mg/L T .005 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

IRON-GF IN PRECIPITATION

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	10	22	6	0	1
s.w.		0.00140	0.00260	0.00000	
mean		0.0110	0.0250	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	24	0.00760	0.00065	8.55
epah	23	0.0791	0.00432	5.46
std 4	23	0.0100	0.00097	9.70
std 5	26	0.0231	0.00249	10.78

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	46	.00180	.00076

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Lead TEST CODE: PBPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 20 µL of sample, an argon internal flow of 50 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .100 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.030 mg/L = .200 Abs. Units
Instrument Detection Limit: 0.001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0043mg/L	.044
std. dev.	.0005mg/L	.0028
R.S.D.	11.1 %	6.4 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	.0004	.0002	
mean	.003	.015	

W .001 mg/L T .005 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

LEAD-GF IN PRECIPITATION

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	14	38	0	0	0
s.w.		0.00040	0.00000	0.00000	
mean		0.0030	0.0000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	27	0.00430	0.00048	11.16
epah	26	0.0444	0.00282	6.35
std 4	22	0.0111	0.00347	31.26
std 5	15	0.0230	0.00286	12.43

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	27	.00260	.00114

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Manganese TEST CODE: MNPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Mn in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 100 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.003 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 5 µg/ml
Accuracy-107% at 0.37 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.00011 0.00037 0.00040
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

MANGANESE IN PRECIPITATION

Operating Range = .00020to 0.030 mg/L

IN - RUN DUPLICATES

Range	<.00020	.00020to0.0060	0.0060to0.0150	0.0150to 0.030	> 0.030
no.	0	45	1	0	1
s.w.		0.00060	0.00040	0.00000	
mean		0.0029	0.0129	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	28	0.00300	0.00157	52.33
qcstd	17	0.2178	0.02089	9.59

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	2	.03740	.04681

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Manganese TEST CODE: MNPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 20 µL of sample, an argon internal flow of 50 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .060 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.010 mg/L gives .210 Abs. Units
Instrument Detection Limit: 0.0002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.060 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0032mg/L	.035
std. dev.	.0003mg/L	.0017
R.S.D.	8.1 %	4.9 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	.0002		
mean	.004		

W .0002mg/L T .0020mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

MANGANESE-GF IN PRECIPITATION

Operating Range = .00020to 0.060 mg/L

IN - RUN DUPLICATES

Range	<.00020	.00020to0.0120	0.0120to0.0300	0.0300to 0.060	> 0.060
no.	15	33	0	0	0
s.w.		0.00020	0.00000	0.00000	
mean		0.0040	0.0000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	24	0.00320	0.00026	8.12
epah	24	0.0354	0.00174	4.92
std 4	23	0.0106	0.00139	13.11
std 5	0	0.0000	0.00000	0.00

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	0	.00000	.00000

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Nickel TEST CODE: NIPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Ni in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 100 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.03 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 1 µg/ml
Accuracy-109% at 0.225 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.00007 0.00026 0.00035
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

NICKEL IN PRECIPITATION

Operating Range = .00010to 0.010 mg/L

IN - RUN DUPLICATES

Range	<.00010	.00010to0.0020	0.0020to0.0050	0.0050to 0.010	> 0.010
no.	44	1	0	1	1
s.w.		0.00110	0.00000	0.00040	
mean		0.0007	0.0000	0.0066	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	24	0.00300	0.00071	23.67
qcstd	17	0.2194	0.02425	11.05

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	0	.00000	.00000

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Nickel TEST CODE: NIPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 90 µL of sample, an argon internal flow of 0 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 4 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .030 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.010 mg/L = .150 Abs. Units
Instrument Detection Limit: 0.0002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.030 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0022mg/L	.0207
std. dev.	.0002mg/L	.0012
R.S.D.	7.3 %	5.9 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	0.0001	0.0001	
mean	0.0008	0.0077	

W .001 mg/L T .005 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

NICKEL-GF IN PRECIPITATION

Operating Range = .00020to 0.030 mg/L

IN - RUN DUPLICATES

Range	<.00020	.00020to0.0060	0.0060to0.0150	0.0150to 0.030	> 0.030
no.	32	18	2	0	3
s.w.		0.00010	0.00010	0.00000	
mean		0.0008	0.0077	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	27	0.00220	0.00016	7.27
epah	16	0.0207	0.00123	5.94
std 4	25	0.0102	0.00129	12.65
std 5	0	0.0000	0.00000	0.00

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	0	.00000	.00000

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Vanadium TEST CODE: VVPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
V in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 100 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.008 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to ? µg/ml
Accuracy-101% at 0.86 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.00004 0.00013 0.00047
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

VANADIUM IN PRECIPITATION

Operating Range = .00020to 0.050 mg/L

IN - RUN DUPLICATES

Range	<.00020	.00020to0.0100	0.0100to0.0250	0.0250to 0.050	> 0.050
no.	33	14	0	0	0
s.w.		0.00040	0.00000	0.00000	
mean		0.0004	0.0000	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	25	0.00280	0.00086	30.71
qcstd	15	0.2105	0.04110	19.52

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	3	.02510	.02171

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Vanadium TEST CODE: VVPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 90 µL of sample, an argon internal flow of 0 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 4 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .010 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.002 mg/L = 0.018 Abs. Units
Instrument Detection Limit: 0.0004 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.010 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.0085mg/L	.010
std. dev.	.0020mg/L	.0012
R.S.D.	23.4 %	12.3 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	.0001	.0006	
mean	.001	.002	

W .0001mg/L T .0010mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

VANADIUM-GF IN PRECIPITATION

Operating Range = .00010to 0.010 mg/L

IN - RUN DUPLICATES

Range	<.00010	.00010to0.0020	0.0020to0.0050	0.0050to 0.010	> 0.010
no.	46	7	1	0	0
s.w.		0.00010	0.00060	0.00000	
mean		0.0010	0.0020	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	25	0.00850	0.00199	23.41
epah	0	0.0000	0.00000	0.00
std 4	18	0.0101	0.00124	12.28
std 5	0	0.0000	0.00000	0.00

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	0	.00000	.00000

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Zinc TEST CODE: ZNPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethhylene tube and preserve with 1% nitric acid.
Reduce to less than 5 ml by evaporation in an oven and dilute to exactly the 5 ml mark at room temperature.
Two filtered composites, one spiked at a higher level, are also taken through this preconcentration procedure, as controls.
A typical run consists of 40 test tubes including blanks, controls, digested standards and samples.
Zn in the solutions is determined as part of a multielement measurement system.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Jarell Ash Atom-Comp -ICP/ES Model 975, 0.75 m, with autosampler and DEC computer for simultaneous concentration printout.PET interface for data message,storage & transfer to computer
Calibration Range: 0 to 100 µg/ml
Resolution:
Sensitivity:
Instrument Detection Limit: 0.005 µg/ml
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0 to 2 µg/ml
Accuracy-108% at 0.45 µg/ml
Precision of Controls- A B
mean
std. dev.
R.S.D.
Precision of Duplicates-low range mid range high range
s.d. 0.0004 0.0009 0.0014
mean
W T

CONTROL LIMITS:

REMARKS: Occasional use of graphite furnace AAS is permitted as backup instrument in event of equipment failure, specific problem solving and to expedite analyses if fewer than four metals are to be determined.

SUMMARY REPORT OF QUALITY CONTROL DATA

ZINC IN PRECIPITATION

Operating Range = .00050 to 0.020 mg/L

IN - RUN DUPLICATES

Range	<.00050	.00050 to 0.0040	0.0040 to 0.0100	0.0100 to 0.020	> 0.020
no.	3	13	27	2	2
s.w.		0.00140	0.00030	0.00070	
mean		0.0027	0.0057	0.0117	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
std	28	0.00370	0.00315	85.14
qcstd	16	0.2420	0.03032	12.53

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
BLK	21	.12250	.23362

DATE 87/08/07

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Zinc TEST CODE: ZNPDT SAMPLE TYPE:Precipdep tot
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:520AF2
REVISION NO: Original DATE: 1982
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- 100 ml
Container-Polyethylene bag (approx. 10x20 cm) with plastic screw top
Preservative- Conc HNO3 (0.25%) - ultra-pure
Other- Sampe kept refrigerated until preserved

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Transfer 50 ml sample from sample bag to calibrated polyethylene test tube and preserve with 1% nitric acid.
Analyze by graphite furnace a.a.s. with 20 µL of sample, an argon internal flow of 50 lpm, and in peak height mode. The other furnace conditions are set according to manual specifications.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 2380 or 603 AAS with PE 400 or PE 500 graphite furnace atomizer systems, and AS 40 autosamplers. Both interfaced with PET computers for data handling.
Calibration Range: 0.0 to .100 mg/L
Resolution: 0.001 Abs. Units
Sensitivity: 0.0300 mg/L gives .600 Abs. Units
Instrument Detection Limit: 0.001 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy-
Precision of Controls-

	A	B
mean	.004 mg/L	.041
std. dev.	.0005mg/L	.0027
R.S.D.	11.8 %	6.5 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	.0004	0.0088	
mean	.004	0.049	

W .001 mg/L T .005 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

ZINC-GF IN PRECIPITATION

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	18	27	1	0	0
s.w.		0.00040	0.00880	0.00000	
mean		0.0040	0.0490	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	26	0.00400	0.00047	11.75
epah	21	0.0411	0.00267	6.50
std 4	23	0.0110	0.00316	28.73
std 5	22	0.0219	0.00264	12.05

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	11	.00250	.00109

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Aluminum TEST CODE:ALPBT SAMPLE TYPE:PrecipNL
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:521AF2
REVISION NO: Original DATE: 1980
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- Approx. 20 ml
Container-Polyethylene bag (approx. 35x20 cm) with plastic screw top
Preservative- Nitric acid (5% v/v) - A.R grade.
Other-

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Leach sample bags for 24 h with 1000 ml 5% HNO3 and save for analysis in polyethylene centrifuge tubes.
Transfer to sample cups of autosampler and determine Al by graphite AAS as part of a multielement analytical system.
Forty samples, including blanks, standards and controls, constitute a typical batch for the measurement step. The raw data is converted into printed analytical results through a PET computer.
Set the instrument so that 20 µL of sample is delivered into furnace and the internal argon flow is 50 lpm. The signal is measured in the peak height mode.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 603 and 2380 AAS with P-E 500 and P-E 400 graphite furnace atomizer systems, respectively, and AS-40 autosamplers. Both interfaced with PET for data handling.
Calibration Range:0.001 to 0.100 mg/L
Resolution: 0.001 abs.
Sensitivity:0.030 mg/L = .200 Abs. Units
Instrument Detection Limit: 0.005 mg/L

PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy-105% at 0.0126 µg/ml; 94% at 0.079 µg/ml
Precision of Controls-

	A	B
mean	.007 mg/L	0.080
std. dev.	.0015mg/L	0.006
R.S.D.	23.2 %	7.5 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	0.0010	0.0019	0.0006
mean	0.009	0.028	0.061

W .001 mg/L T .010 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

ALUMINUM-GF IN NLPRECIP

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.10C
no.	1	21	17	3	1
s.w.		0.00100	0.00190	0.00060	
mean		0.0090	0.0280	0.0610	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	27	0.00650	0.00151	23.23
epah	29	0.0801	0.00597	7.45
std 4	28	0.0107	0.00263	24.58
std 5	23	0.0215	0.00433	20.14

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	17	.00630	.00113

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Copper TEST CODE:CUPBT SAMPLE TYPE:PrecipNL
UNIT: Water SUPERVISOR: P Vijan

METHOD CODE:521AF2
REVISION NO: Original DATE: 1980
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- Approx. 20 ml
Container-Polyethylene bag (approx. 35x20 cm) with plastic screw top
Preservative- Nitric acid (5% v/v) - A.R grade.
Other-

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Leach sample bags for 24 h with 1000 ml 5% HNO3 and save for analysis in polyethylene centrifuge tubes.
Transfer to sample cups of autosampler and determine Cu by graphite AAS as part of a multielement analytical system.
Forty samples, including blanks, standards and controls, constitute a typical batch for the measurement step. The raw data is converted into printed analytical results through a PET computer.
Set the instrument so that 90 µL of sample is delivered into furnace and the internal argon flow is 50 lpm. The signal is measured in the peak height mode.

INTERFERENCES: None

REPORTING RESULTS: 4 significant figures
INSTRUMENTATION: Perkin-Elmer Models 603 and 2380 AAS with P-E 500 and P-E 400 graphite furnace atomizer systems, respectively, and AS-40 autosamplers. Both interfaced with PET for data handling.
Calibration Range: 0.0002 to 0.060 mg/L
Resolution: 0.001 abs.
Sensitivity:0.030 mg/L = 0.250 Abs. Units
Instrument Detection Limit: 0.0002 mg/L
PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.060 mg/L
Accuracy- Data to be updated
Precision of Controls-

	A	B
mean	.0034mg/L	0.0328
std. dev.	.0002mg/L	0.0017
R.S.D.	6.5 %	5.2 %

Precision of Duplicates-	low range	mid range	high range
s.d.	0.0002	0.0007	
mean	0.0009	0.0235	

W .0001mg/L T .0010mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

COPPER-GF IN NLPRECIP

Operating Range = .00010to 0.060 mg/L

IN - RUN DUPLICATES

Range	<.00010	.00010to0.0120	0.0120to0.0300	0.0300to 0.060	> 0.060
no.	27	17	1	0	0
s.w.		0.00015	0.00071	0.00000	
mean		0.0009	0.0235	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	30	0.00340	0.00022	6.47
epah	12	0.0328	0.00171	5.21
std 4	22	0.0099	0.00120	12.12
std 5	15	0.0209	0.00218	10.43

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	10	.00020	.00004

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Iron TEST CODE:FEPBT SAMPLE TYPE:PrecipNL
UNIT: Water SUPERVISOR: P Vijan

METHOD CODE:521AF2
REVISION NO: Original DATE: 1980
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- Approx. 20 ml
Container-Polyethylene bag (approx. 35x20 cm) with plastic screw top
Preservative- Nitric acid (5% v/v) - A.R grade.
Other-

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Leach sample bags for 24 h with 1000 ml 5% HNO_3 and save for analysis in polyethylene centrifuge tubes.
Transfer to sample cups of autosampler and determine Fe by graphite AAS as part of a multielement analytical system.
Forty samples, including blanks, standards and controls, constitute a typical batch for the measurement step. The raw data is converted into printed analytical results through a PET computer.
Set the instrument so that 20 µL of sample is delivered into furnace and the internal argon flow is 50 lpm. The signal is measured in the peak height mode.

INTERFERENCES: None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 603 and 2380 AAS with P-E 500 and P-E 400 graphite furnace atomizer systems, respectively, and AS-40 autosamplers. Both interfaced with PET for data handling.
Calibration Range: 0.001 to 0.1 mg/L
Resolution: 0.001 abs.
Sensitivity: 0.030 - .200 Abs. Units
Instrument Detection Limit: 0.001 mg/L

PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy- 110% at 0.0044 µg/ml: 108% at 0.0215 µg/ml
Precision of Controls-

	A	B
mean	.008 mg/L	0.080
std. dev.	.0009mg/L	0.004
R.S.D.	11.2 %	5.0 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	0.0018	0.0019	0.0015
mean	0.013	0.033	0.058

W .0005mg/L T .0050mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

IRON-GF IN NLPRECIP

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	3	20	18	3	3
s.w.		0.00180	0.00190	0.00150	
mean		0.0130	0.0330	0.0580	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	30	0.00760	0.00085	11.18
epah	27	0.0803	0.00401	4.99
std 4	30	0.0110	0.00192	17.45
std 5	26	0.0231	0.00249	10.78

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	46	.00180	.00076

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Lead TEST CODE:PBPBT SAMPLE TYPE:PrecipNL
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:521AF2
REVISION NO: Original DATE: 1980
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- Approx. 20 ml
Container-Polyethylene bag (approx. 35x20 cm) with plastic screw top
Preservative- Nitric acid (5% v/v) - A.R grade.
Other-

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Leach sample bags for 24 h with 1000 ml 5% HNO3 and save for analysis in polyethylene centrifuge tubes.
Transfer to sample cups of autosampler and determine Pb by graphite AAS as part of a multielement analytical system.
Forty samples, including blanks, standards and controls, constitute a typical batch for the measurement step. The raw data is converted into printed analytical results through a PET computer.
Set the instrument so that 20 µL of sample is delivered into furnace and the internal argon flow is 50 lpm. The signal is measured in the peak height mode.

INTERFERENCES:-None

REPORTING RESULTS: To 3 decimals
INSTRUMENTATION: Perkin-Elmer Models 603 and 2380 AAS with P-E 500 and P-E 400 graphite furnace atomizer systems, respectively, and AS-40 autosamplers. Both interfaced with PET for data handling.
Calibration Range: 0.001 to 0.100 mg/L
Resolution: 0.001 abs.
Sensitivity: 0.030 mg/L = .200 Abs. Units
Instrument Detection Limit: 0.001 mg/L

PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.100 mg/L
Accuracy- 94% at 0.0045 µg/ml; 84% at 0.020 µg/ml
Precision of Controls-

	A	B
mean	.0044mg/L	0.0419
std. dev.	.0003mg/L	0.0084
R.S.D.	6.4 %	20.1 %

Precision of Duplicates-low range mid range high range

s.d.	0.0006
mean	0.003

W .001 mg/L T .010 mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

LEAD-GF IN NLPRECIP

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	25	18	0	1	0
s.w.		0.00060	0.00000	0.00640	
mean		0.0030	0.0000	0.0950	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	27	0.00440	0.00028	6.36
epah	26	0.0419	0.00844	20.14
std 4	21	0.0112	0.00217	19.37
std 5	15	0.0230	0.00286	12.43

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	27	.00260	.00114

DATE 87/02/25

ANALYTICAL PROCEDURE
Inorganic Trace Contaminants Section

TEST NAME: Zinc TEST CODE:ZNPBT SAMPLE TYPE:PrecipNL
UNIT: Water SUPERVISOR: P. Vijan

METHOD CODE:521AF2
REVISION NO: Original DATE: 1980
NATURE OF LAST REVISION:

SAMPLE HANDLING:
Quantity Required- Approx. 20 ml
Container-Polyethylene bag (approx. 35x20 cm) with plastic screw top
Preservative- Nitric acid (5% v/v) - A.R grade.
Other-

SAMPLE PREPARATION:Partial Extn.- Total Extn.-Yes % Extracted-
Procedure- Leach sample bags for 24 h with 1000 ml 5% HNO3 and save for analysis in polyethylene centrifuge tubes.
Transfer to sample cups of autosampler and determine Zn by graphite AAS as part of a multielement analytical system.
Forty samples, including blanks, standards and controls, constitute a typical batch for the measurement step. The raw data is converted into printed analytical results through a PET computer.
Set the instrument so that 20 µL of sample is delivered into furnace and the internal argon flow is 50 lpm. The signal is measured in the peak height mode.

INTERFERENCES: None

REPORTING RESULTS: 3 significant figures
INSTRUMENTATION: Perkin-Elmer Models 603 and 2380 AAS with P-E 500 and P-E 400 graphite furnace atomizer systems, respectively, and AS-40 autosamplers. Both interfaced with PET for data handling.
Calibration Range: 0.001 to 0.100 mg/L
Resolution: 0.001 abs.
Sensitivity: 0.030 mg/L = .600 Abs. Units
Instrument Detection Limit: 0.001 mg/L

PERFORMANCE CHARACTERISTICS:
Routine Operating Range- 0.0 to 0.060 mg/L
Accuracy- Data to be updated
Precision of Controls-

	A	B
mean	.004 mg/L	0.040
std. dev.	.0003mg/L	0.003
R.S.D.	7.8 %	8.0 %

Precision of Duplicates-

	low range	mid range	high range
s.d.	0.0006	0.0011	0.0014
mean	0.005	0.031	0.040

W .0005mg/L T .0050mg/L

CONTROL LIMITS:

REMARKS:

SUMMARY REPORT OF QUALITY CONTROL DATA

ZINC-GF IN NLPRECIP

Operating Range = .00100to 0.100 mg/L

IN - RUN DUPLICATES

Range	<.00100	.00100to0.0200	0.0200to0.0500	0.0500to 0.100	> 0.100
no.	19	26	2	0	0
s.w.		0.00060	0.00110	0.00000	
mean		0.0050	0.0310	0.0000	

QA CONTROL SAMPLES

SAMPLE I.D.	NO.	MEAN	STD. DEV.	R.S.D.
epal	29	0.00400	0.00031	7.75
epah	24	0.0404	0.00321	7.95
std 4	27	0.0109	0.00221	20.28
std 5	22	0.0219	0.00264	12.05

BLANKS

BLANK I.D.	NO.	MEAN	STD. DEV.
blk	11	.00250	.00109

DATE 87/02/25